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(54) **LENS AND LED MODULE HAVING THE SAME**

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F21K 99/00	(2016.01)
G02B 19/00	(2006.01)
F21V 13/04	(2006.01)
F21Y 101/00	(2016.01)

(52) **U.S. Cl.**

CPC ***F21K 9/50*** (2013.01); ***F21V 13/04*** (2013.01); ***G02B 19/0028*** (2013.01); ***G02B 19/0061*** (2013.01); *F21V 5/04* (2013.01); *F21Y 2101/00* (2013.01)

(58) **Field of Classification Search**

CPC F21V 5/04; F21V 5/048; F21V 13/04; F21V 5/046; F21V 5/08; F21V 5/00; F21K 9/50; F21K 9/00; G02B 19/0028; G02B 19/0061; F21Y 2101/00; F21Y 2115/10

See application file for complete search history.

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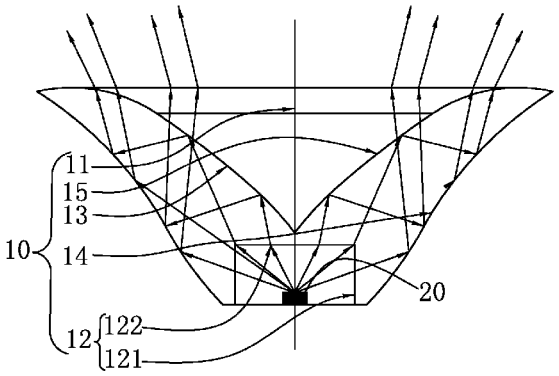
(57) **ABSTRACT**

A lens includes an optical axis, a light source recess arranged through the optical axis, a reflection surface crossing through the optical axis, and a critical reflection surface which is arranged in a spaced relationship with the optical axis. The critical reflection surface is arranged between the light source recess and the reflection surface and receives the light from the light source recess and the reflection surface and reflects the light from the light source recess and the reflection surface towards the reflection surface. The emission light of the lens is light emitted forward of the light emitting surface which is reflected via the reflection surface and the critical reflection surface. Therefore, people cannot receive directly light emitted forward of the LED after it cross through the lens. In result, high luminance light from the LED is prevented from ripping into eyes, which achieve the aim of anti-glare.

8 Claims, 3 Drawing Sheets



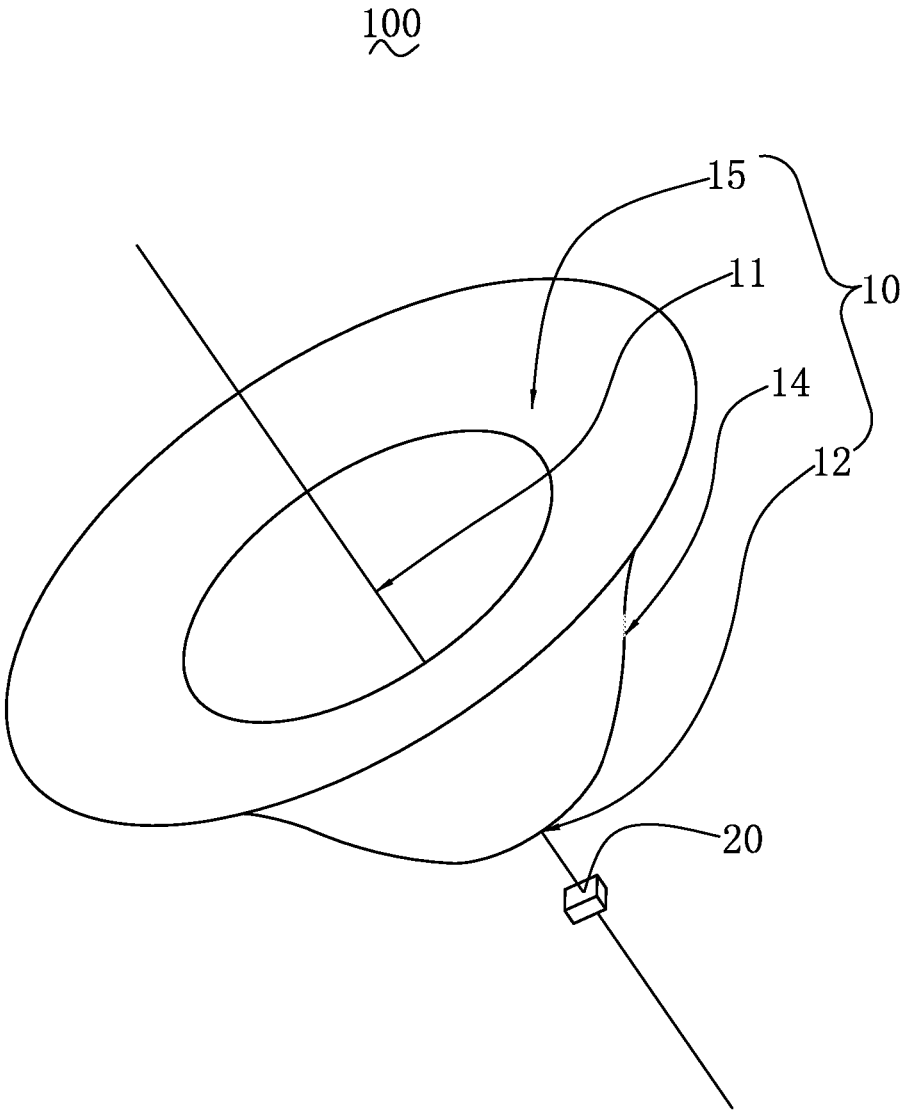


FIG. 1

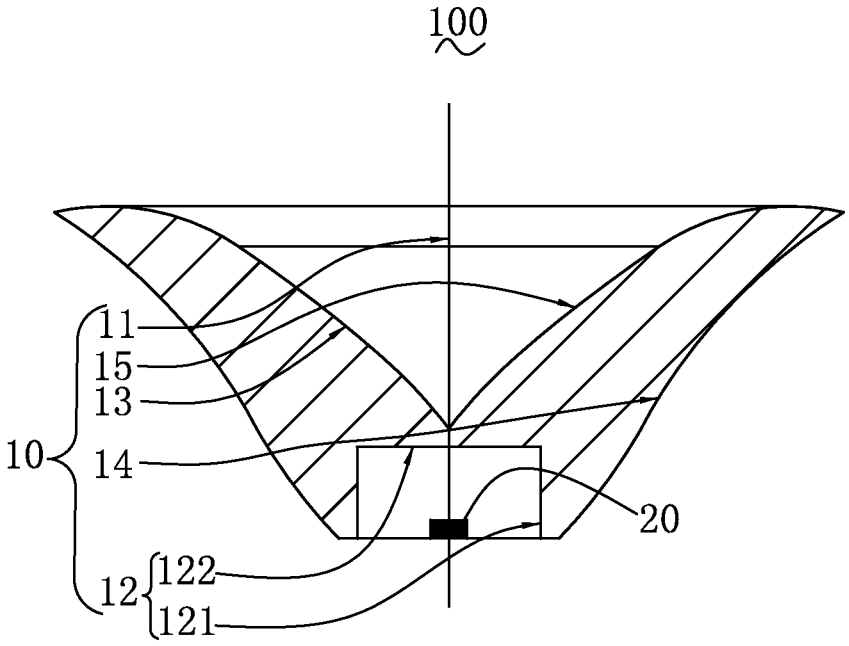


FIG. 2A

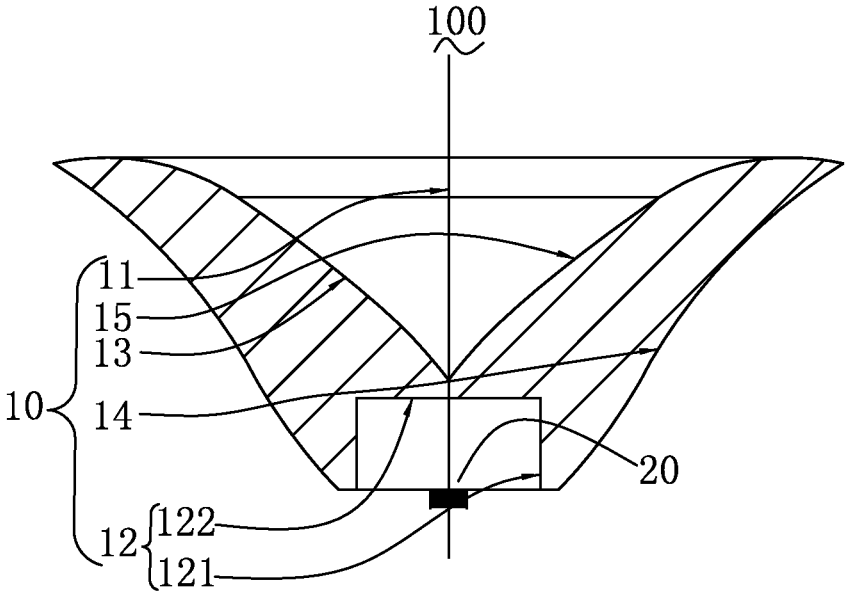


FIG. 2B

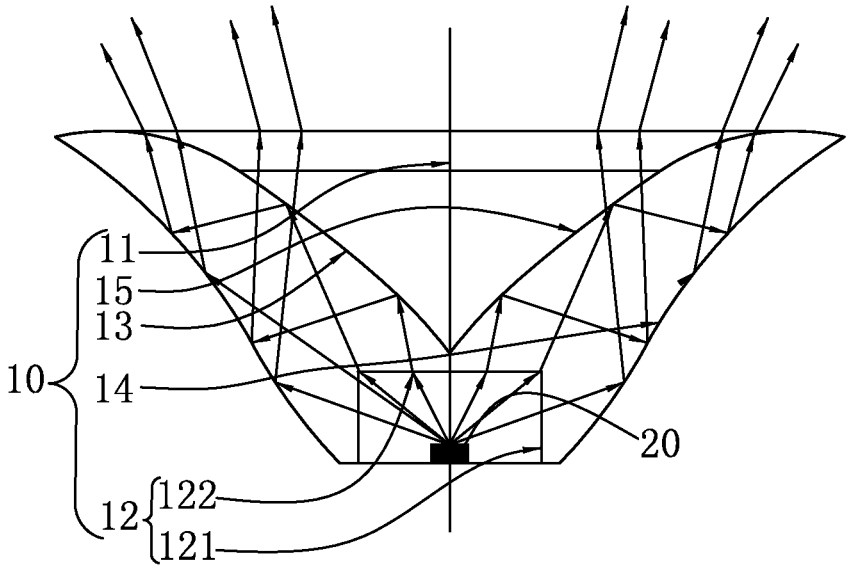


FIG. 3

LENS AND LED MODULE HAVING THE SAME

RELATED APPLICATION

This application claims benefit of the Chinese Application, CN201310552878.1, filed on Nov. 5, 2013, the entire specification of which is hereby incorporated by reference.

BACKGROUND

1. Technical Field

The disclosure relates to a lighting devices, and more particularly to a lens and a LED module having the same.

2. Description of the Related Art

For years, people have used traditional incandescent or fluorescence lighting apparatus in order to address their interior lighting concerns. However, such lighting apparatus presents a number of drawbacks. For example, the popular halogen apparatus presents the following drawbacks, such as relatively high power consumption, inefficiency of light dispersion due to the placement of its metal shield in the line sight of the halogen bulb, and its limited effectiveness in preventing glare from the halogen bulb.

Recently, a number of LED lighting apparatuses have been designed to replace the halogen apparatus, as well as other traditional incandescent or fluorescence lighting apparatuses. As idea of humanized design for illumination is looked so deeply into the human mind, the illumination design should bring into better effect in home lighting and commercial lighting so as to satisfy the requirements of physiology and psychology of people in all of aspects. As well known, glare may be formed since the LED lighting apparatuses have feature of high luminance. Therefore, it is an important standard for a lamp to reduce glare, and anti-glare functions also is a critical factor for quality of a lamp.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the embodiments can be better understood with references to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the embodiments. Moreover, in the drawings, like reference numerals designate corresponding parts throughout two views.

FIG. **1** is an explored view of an LED module according to an embodiment.

FIG. **2**A and FIG. **2**B are schematic views of an LED of the LED module of FIG. **1** which is located in different position.

FIG. **3** is light path view of the LED module of FIG. **1**.

DETAILED DESCRIPTION

The disclosure is illustrated by way of example and not by way of limitation in the figures of the accompanying drawings. It should be noted that references to "an" or "one" embodiment in this disclosure are not necessarily to the same embodiment, and such references mean at least one.

Referring to FIG. **1** to FIG. **3**, an LED module **100** is shown. The LED module **100** includes a lens **10** and a LED **20** housed in the lens **10**. The lens **10** includes an optical axis **11**, a light source recess **12** arranged through the optical axis **11**, a reflection surface **13** crossing through the optical axis **11**, and a critical reflection surface **14** arranged in a spaced relationship with the optical axis **11**.

As same as a traditional lens, the optical axis **11** is a universal feature for all of lens and used to dispose the light source, namely the LED **20**. Moreover, the optical axis **11** is a guide for optic design.

The light source recess **12** is configured for mounting the LED **20** or other traditional light source. In the present embodiment, the light source is the LED **20**. When dimension scale between the lens **10** and the light source is as same as that between the lens **10** and the LED **20**, the light source may be other traditional light source, such as incandescent or fluorescence lighting apparatuses, and so on. As shown in FIG. **2**A and FIG. **2**B, the LED **20** may be mounted into the light source recess **12** or at outer side of the light source recess **12**. When the LED **20** is disposed into the light source recess **12**, a bottom side of the LED **12** is flush with an end of the light source recess **12** for sufficiently taking advantage of the light emitted forward of the LED **12** and ease to assemble the lens **11** and the LED **20**. When the LED **20** is mounted at outer side of the light source recess **112**, a light emitting side of the LED **12** is flush with the end of the light source recess **12** for sufficiently taking advantage of the light emitted forward of the LED **20**. In the present embodiment, the bottom side of the LED **20** is flush with the end of the light source recess **12**. The light source recess **12** has a central axis which overlaps with the optical axis **111** of the lens **11** for ease to optic design. The light source recess **12** includes a side wall **121** and a top wall **122**. The light emitting forward of the LED **20**

The reflection surface **13** is face to the top wall **122** of the light source recess **12**. The optical axis **11** cross through the reflection surface **13** so that the reflection surface **13** can receive the light emitted from the top wall **122** and reflect it towards the critical reflection surface **14**. Referring to FIG. **2**, the LED **20** may be simplified into a point light source since the dimension of the LED **20** is far less than that of the lens **10**. The light path emitted from the top wall **122** has a shape of fan in a section view along the optical axis **11**. That is to say, each of the light paths emitted from the top wall **122** has a different angle with the optical axis **11** respectively. Therefore, in order to reflect the light emitted from the top wall **122** into the critical reflection surface **14**, tangent line of any point of the reflection surface **13** in the section view along the optical axis **11** have different angle with the optical axis **11** respectively.

The critical reflection surface **14** is configured for reflecting all of light received from the reflection surface **13** and the side wall **121**. The critical reflection surface **14** is arranged between the light source recess **12** and the reflection surface **13** and is formed a inclined surface like a mortar. In a section view along the optical axis **11**, an end of outline of the critical reflection surface **14** is connected to the reflection surface **13**, and the other is connected to the free end of the side wall **121** so as to receive all of light emitted forward to the reflection surface **13** and the side wall **121** of the light source recess **12**. The critical reflection surface **14** is designed to have an angle capable of reflecting the received light.

The lens **10** further includes a light emitting surface **15**. The light emitting surface **15** and the reflection surface **13** are one and the same. The light emitting surface **15** is located in outer side of the lens **10**. The reflection surface **13** is located in inner side of the lens **10**. In order to control beam width of the light emitted forward of the light emitting surface **15** so as to form controlled illumination pattern on the illuminated area, a plurality of convex lenses are formed

in the radial direction and in the circumferential direction around the LED **20** which is provided at the center thereof. Each of the convex lenses has a radius R and a height h and a lateral dimensional L. The radius R, the height h, and the lateral dimensional L are used to design according to beam wide of incident light. According to embodiments of the present invention, the convex lenses can be made to provide different beam widths by varying the parameters such as R, h, and L. For example, in one embodiment, a configuration with R=3.0 mm, h=0.1 mm, L=1.33 mm is used for a narrow beam having a beam width of about 12-17 degrees; R=2.0 mm, h=0.55 mm, and L=3.0 mm is used for a wide beam having a beam width of about 25-30 degrees.

The LED **20** is a semiconductor light source and transforms power into light. The LED **20** presents many advantages over traditional light sources including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. A center of the LED **20** is arranged on the optical axis **11** of the lens **10** for ease to optic design.

In use, the emission light of the lens **10** is light emitted forward of the light emitting surface **15** which is reflected via the reflection surface **13** and the critical reflection surface **15**. Therefore, people cannot receive directly light emitted forward of the LED **20** after it cross through the lens **10**. In result, high luminance light from the LED **20** is prevented from ripping into eyes, which achieve the aim of anti-glare.

While the disclosure has been described by way of example and in terms of exemplary embodiment, it is to be understood that the disclosure is not limited thereto. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A lens comprising:

an optical axis;

a light source recess arranged through the optical axis;

a reflection surface crossing through the optical axis;

a light emitting surface; and

a critical reflection surface which is arranged in a spaced relationship with the optical axis, wherein the reflection surface receives the light from the light source recess and reflects the light from the light source recess onto the critical reflection surface, the critical reflection surface is arranged between the light source recess and the reflection surface and receives the light from the light source recess and the reflection surface and reflects the light from the light source recess and the reflection surface towards the reflection surface, the light emitting surface has same structure with the reflection surface, the light reflected from the critical reflection surface is emitted via the light emitting surface.

2. The lens of claim **1**, wherein the lens is a solid of revolution obtained by rotating a plane curve around the optical axis.

3. The lens of claim **1**, wherein the reflection surface interconnects with the critical reflection surface.

4. The lens of claim **1**, wherein the light emitting surface is located in outer side of the lens, the reflection surface is located in inner side of the lens.

5. The lens of claim **1**, wherein tangent line of any point of the reflection surface in the section view along the optical axis have different angle with the optical axis respectively.

6. A LED module, comprising:

an LED; and

a lens according to one lens of claim **1**, the lens mounted on the light path of the LED.

7. The LED module of claim **6**, wherein the light source recess has a center axis along axial direction thereof which overlaps with the optical, a bottom side of the LED is flush with the end of the light source recess.

8. The LED module of claim **6**, wherein the light source recess has a center axis along axial direction thereof which overlaps with the optical axis, the LED has a light emitting side which is flush with the end of the light source recess.

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